FORM PTO-1390 (REV. 9-2001) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 1462-P02747US0

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 10/009405

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/KR00/00486	18 May 2000	18 June 1999

TITLE OF INVENTION
IMAGE COMPOSITING SYSTEM OF MULTICAMERA AND METHOD THEREOF

APPLICANT(S) FOR DO/EO/US
HA, Young-Kyun

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [X] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [X] Other items or information:

Copy of Form PCT/IB/308 (1996)

JC13 Rec'd PCT/PTO 07 DEC 2001

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/009405	INTERNATIONAL APPLICATION NO. PCT/KR00/00486	ATTORNEY'S DOCKET NUMBER 1462-P02747US0

21. [X] The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

	CALCULATIONS	PTO USE ONLY
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 1,040	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 130	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	3 - 20 =	0	x **$18.00**	$ -0-	
Independent claims	1 - 3 =	0	x **$84.00**	$ -0-	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$280.00**	$ -0-	

	CALCULATIONS	PTO USE ONLY
TOTAL OF ABOVE CALCULATIONS =	$ 1,170	
[X] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +	$ 585	
SUBTOTAL =	$ 585	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).	$ -0-	
TOTAL NATIONAL FEE =	$ 585	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +	$ -0-	
TOTAL FEES ENCLOSED =	$ 585	
	Amount to be refunded:	$
	charged:	$

a. [X] A check in the amount of $ 585.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ________ in the amount of $ ________ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 04-1406. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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JOHN B. BERRYHILL
NAME

36,452
REGISTRATION NUMBER

IMAGE COMPOSITING SYSTEM OF MULTICAMERA AND METHOD THEREOF

Technical Field

The present invention relates to an image composing system capable of taking a picture of high resolution in a high speed by composing videos taken by a number of video cameras in one video and a method thereof.

Background Art

Generally, in order to obtain a digital video of high resolution, a digital scanner or a digital video camera is used. The digital scanner scans vertically by using a charge coupled device arranged in series, and the digital video camera takes a picture by using a charge-coupled device arranged in a matrix.

In case of using the digital scanner or the digital video camera, there is needed a very expensive device to achieve a video of high resolution and high quality. Accordingly, a user uses a conventional inexpensive analog video camera, by which a video data cannot be processed.

Even though the conventional expensive digital video camera capable of easily processing the video data and saving a kind of data is used, the increase of the resolution is limited. Since the more increase of the resolution is the more reduction of processing speed, it is impossible to take a picture quickly.

In addition, since the dimension of a target area pictured by the conventional digital video camera is in inversely proportional to the resolution, it is impossible to take a picture of a large display such as a display of a theater.

inexpensive analog camera.

The system further comprises a calibration data input for inputting a reference point of each segment display to the controller to reduce an error produced from discordance of the segment displays.

According to another aspect of the present invention, there is provided with, in an image composing system comprising a camera assembly consisting of a number of analog cameras, a video signal selector for connecting a signal path of each camera, a video signal converter for converting a video signal received from the camera into a digital signal, a controller for composing each digital video signal of the camera in one video to convert a video data, and a calibration data input for inputting a reference point of each segment display to the controller, a method of composing the image by using the image composing system, the method comprising the steps of: operating the cameras of the camera assembly by receiving a control signal from the controller; inputting a reference point of each segment display through the calibration data input to calibrate a discordance of the segment displays with reference to a display on the controller; if the initialing step on each camera is completed, selecting an interested camera and connecting the signal path by the video signal selector; converting the analog signal from the selected camera into the digital signal; converting each digital video signal converted at the above step into the digital video data; calibrating the video data converted at the above step by the reference point inputted at the input step and composing the video data in one video; and saving and displaying the composed video data at the calibrating step.

Brief Description of the Drawings

The above object, other features and advantages of the present invention will become more apparent by describing the preferred embodiment thereof with reference to the accompanying drawings, in which:

Fig. 1 is a top view illustrating an image composing system according to a preferred embodiment of the present invention;

Fig. 2 is a front view illustrating a camera arrangement of an image composing system according to a preferred embodiment of the present invention;

Fig. 3 is a flowchart of an image composing method according to a preferred embodiment of the present invention;

Fig. 4 is a view illustrating normal reference points of segment displays which are divided into four; and

Figs. 5 to 8 are views illustrating an example of distorted segment display.

Best Mode for Carrying Out the Invention

Now, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.

As shown in Fig. 1, the image composing system according to a preferred embodiment of the present invention comprising a camera assembly 10 consisting of a number of analog cameras 1, a video signal selector 20 for connecting a signal path of each camera 1, a video signal converter 30 for converting a video signal received from the camera 1 into a digital signal, a controller 40 for composing each digital video signal of the camera 1 in one video to convert a video data, and a calibration data input 50 for inputting a reference point of each segment display to the controller 40.

Specifically, the camera assembly 10, as shown in

Fig. 2, has a number of analog cameras each arranged in a divided target area, wherein the camera assembly is a matrix of m × n cameras to divide one rectangular display into a number of segment displays.

Such a camera assembly may consist of an inexpensive analog video camera, and comprises a camera supporting frame (not shown) for supporting the camera 1 and for adjusting an orientation of the camera 1. A kind of camera supporting frames has been suggested in the prior art.

When the camera 1 is installed onto the camera supporting frame, corners of the segment displays are preferably arranged to coincide with each other by adjusting the orientation of the cameras. Since it is very difficult to arrange the camera to coincide with the corners of segment display, however, the cameras are preferably arranged so that the target areas are overlapped with each other.

The video signal selector 20 is to connect the signal path of the camera by sequentially selecting one by one among the number of cameras or by selecting one row or column among the cameras.

The video signal converter 30 is to convert a video signal received from the camera 1 connected to the video signal selector 20 into a digital video signal, and it will be understood by those skilled in the art that various changes in form and details may be made.

The controller 40 is to control the operation of the camera assembly 10, the video signal selector 20 and the video signal converter 30, and to compose each digital video signal of the camera 1 converted in the video signal converter 30 in one video and save it therein. The controller may be one of a controller of a common personal computer or a workstation having an image composing program, and a super computer.

The image composing program is not to process a mere function of overlapping the videos, but to calibrate the video with reference to a reference point inputted by an user so that the image is coincided with the actual video of the target area.

Such an image composing program is to predict all distortion of the images taken by each camera and to calibrate the images, as shown in Figs. 5 to 8. As shown in Fig. 4, the corners of the segment display are indicated by P_{iA}, P_{iB}, P_{iC}, and P_{iD}, respectively (wherein i is a number of camera), a reference coordinate of the target area in Fig. 4 is indicated by {x, y} and a reference coordinate of the target area in Figs. 5 to 8 is indicated by {X, Y}.

Four corners are rarely positioned on their exact position as shown in Fig. 4. Substantially, due to the mounting error of the camera, the error of a lens, or the machining error of components, the corners are rotated as shown in Fig. 5, a magnification of the video is changed as shown in Fig. 6, the corners are distorted in every directions as shown in Figs. 7 and 8, or these phenomenon may be complicatedly happened.

Therefore, in order to compose the displays shown in Figs. 5 to 8 as the display shown in Fig. 4, the coordinate of the actual display has to convert into the coordinate of the target display.

Specifically, the formula of this coordinate is expressed by $x = f_x(X, Y)$, $y = f_y(X, Y)$ by using a linear geometry and coordinate principal.

Wherein (X, Y) is a coordinate of four points P'_{iA}, P'_{iB}, P'_{iC}, and P'_{iD} of the actual display, these points are converted from the coordinate {X, Y} of the actual display into the in to the coordinate of four points P_{iA}, P_{iB}, P_{iC}, and P_{iD} by a temporary coordinate {x, y}.

Therefore, the user can eliminate the error of the

display or the overlapped display by designating the positions of four corners or particular reference points of the actual display with using a cursor of a mouse.

The coordinate converting function suitable to the magnifying/reducing conversion, the distorting conversion, the rotating conversion, and it will be understood by those skilled in the art that various changes in form and details may be made. The initialing process is achieved by one setting operation if the distance of the camera assembly and the target display is constant.

The image composing system of the present invention further comprises a calibration data input 50, such as a mouse, a keyboard, a joystick, or a touch screen, for inputting a reference point of each segment display to the controller 40 to reduce the error produced from the discordance of the segment displays.

Referring to Fig. 3, the method of composing several images according to the present invention comprises the steps of; taking a picture of the target area (step S1); initialing picture conditions (step S2); selecting a particular camera (step S3); receiving a video signal from the selected camera (step S4); processing videos of segment displays (step S5); composing the segment displays (step S6); and processing the composed display (step S7).

Specifically, if the video composing system of the present invention is installed on a particular position, the camera 1 of the camera assembly 10 is received with a control signal of the controller 40 to take a picture of the target area (step S1).

At the initialing step S2, the user inputs a reference point of each segment display through the calibration data input 50 to calibrate the discordance of the segment displays with reference to the display on

the controller 40.

At the selecting step S3, if the initialing step on each camera is completed, the video signal selector 20 selects the interested camera 1 and connects the signal path.

At the receiving step S4, the analog signal from the selected camera is converted into the digital signal.

At that time, the controller 40 controls the video signal selector 20 to sequentially select each camera 1 till the video signals of all camera is converted into the digital signal.

At the processing step S5, each digital video signal converted at the step S4 is converted into the digital video data.

At the composing step S6, the video data converted at the step S5 is calibrated by the reference point inputted at the step S2 and is composed in one image.

At the processing step S7, the composed video data at the step S6 is saved and is displayed.

And then, the above processes are compl·ted or repeated to achieve the precise picture.

According to the method of composing images according to the present invention, it will overcome the picturing errors predicted at the initialing process, the display is sequentially pictured by·using a number of cameras, and the pictured video data is converted and composed.

Industrial Applicability

As apparent from the above description, the image composing system according to the present invention may reduce a cost of system and take a picture of a high resolution, by using an inexpensive analog.

Accordingly, the user may take a picture of a digital video, which the data is easily processed and

saved, by using an analog camera cheaper than a digital camera.

By using the image composing system and the method thereof, since it can increase the resolution regardless of the dimension of the target area to be pictured, it is possible to take a picture of a large display such as a display of a theater and easily edit the video.

Claims

1. An image composing system comprising:

a camera assembly having a number of analog cameras, each arranged in a divided target area;

a video signal selector for selecting a particular camera for connecting a signal path of the camera;

a video signal converter for converting a video signal received from the camera connected to the video signal selector into a digital video signal; and

a controller for controlling operation of the camera assembly, the video signal selector and the video signal converter, and for converting each digital video signal of the cameras converted in the video signal converter into a video data and composing it in one image to save and display the image.

2. The system as claimed in claim 1, wherein the camera assembly is a matrix of m × n cameras to divide one rectangular display into a number of segment displays.

3. The system as claimed in claim 1, further comprising a calibration data input for inputting a reference point of each segment display to the controller to reduce an error produced from discordance of the segment displays.

4. In a video composing system comprising a camera assembly consisting of a number of analog cameras, a video signal selector for connecting a signal path of each camera, a video signal converter for converting a video signal received from the camera into a digital signal, a controller for composing each digital video signal of the camera in one image to

convert a video data, and a calibration data input for inputting a reference point of each segment display to the controller, a method of composing the image by using the image composing system, the method comprising the steps of:

operating the cameras of the camera assembly by receiving a control signal from the controller;

inputting a reference point of each segment display through the calibration data input to calibrate a discordance of the segment displays with reference to a display on the controller;

if the initialing step on each camera is completed, selecting an interested camera and connecting the signal path by the video signal selector;

converting the analog signal from the selected camera into the digital signal;

converting each digital video signal converted at the above step into the digital video data;

calibrating the video data converted at the above step by the reference point inputted at the input step and composing the video data in one video; and

saving and displaying the composed video data at the calibrating step.

Fig. 1

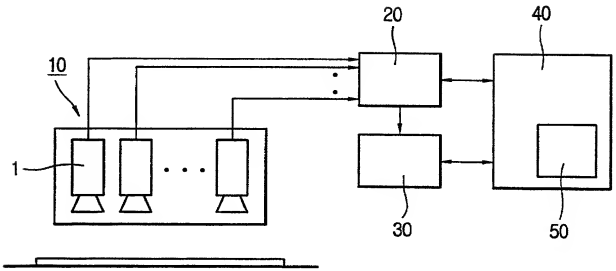


Fig. 2

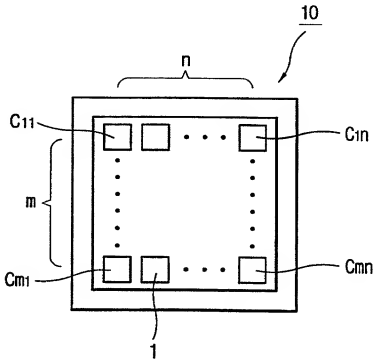


Fig. 3

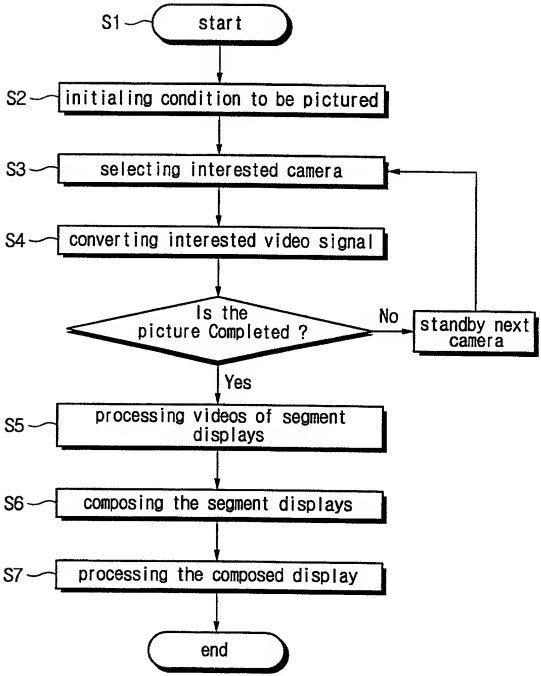


Fig. 4

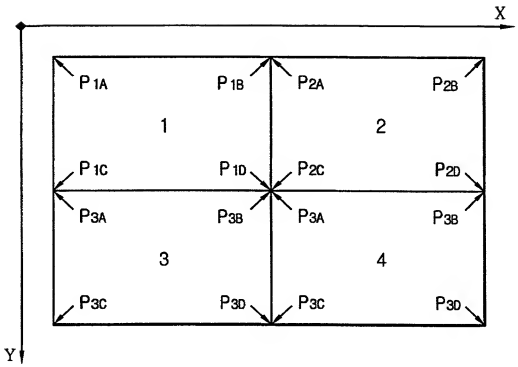

X
Y
P1A
P1B
P2A
P2B
1
2
P1C
P1D
P2C
P2D
P3A
P3B
P3A
P3B
3
4
P3C
P3D
P3C
P3D

Fig. 5

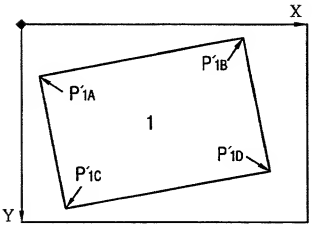


Fig. 6

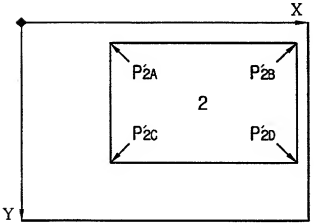


Fig. 7

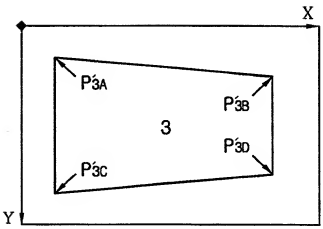
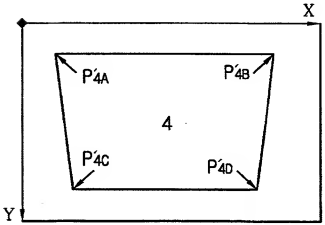


Fig. 8



DECLARATION, POWER OF ATTORNEY AND POWER TO INSPECT

As a below named inventor, I hereby declare:

that my residence, post office address and citizenship are as stated below next to my name;

that I verily believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the invention entitled: **"IMAGE COMPOSITING OF MULTICAMERA AND METHOD THEREOF"**

the specification of which [check one(s) applicable]
_X_ was filed December 7, 2001 as PCT International/U.S. Application No. 10/009,405
___ and was amended by Amendment filed _____ (if applicable); [or];
___ is attached to this Declaration, Power of Attorney and Power to Inspect;

that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above; and

that I acknowledge my duty to disclose information which is material to the examination of this application in accordance with Rule 56(a) [37CFR§1.56(a)].

CLAIM UNDER 35 U.S.C. §119: I hereby claim foreign priority benefits under 35 USC §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application of which priority is claimed:

Prior Foreign Application(s)		Filing Date	Priority Claimed
Application No.	Country	Day-Mo-Year	Yes - No
PCT/KR00/00486	WIPO	18 May 2000	Yes
1999/22992	Korea	18 June 1999	Yes

POWER OF ATTORNEY: As inventor, I hereby appoint the practitioners associated with **CUSTOMER NO. 000110** as my attorneys or agents with full power of substitution to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

POWER TO INSPECT: I hereby give **DANN, DORFMAN, HERRELL AND SKILLMAN, P.C.** of Philadelphia, PA or its duly accredited representatives power to inspect and obtain copies of the papers on file relating to this application.

SEND CORRESPONDENCE TO: CUSTOMER NO. 000110

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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